July 25, 1950 T. A. PRUGH 2,516,146

RING CIRCUIT

Filed June 16, 1945 2 Sheets-Sheet 1

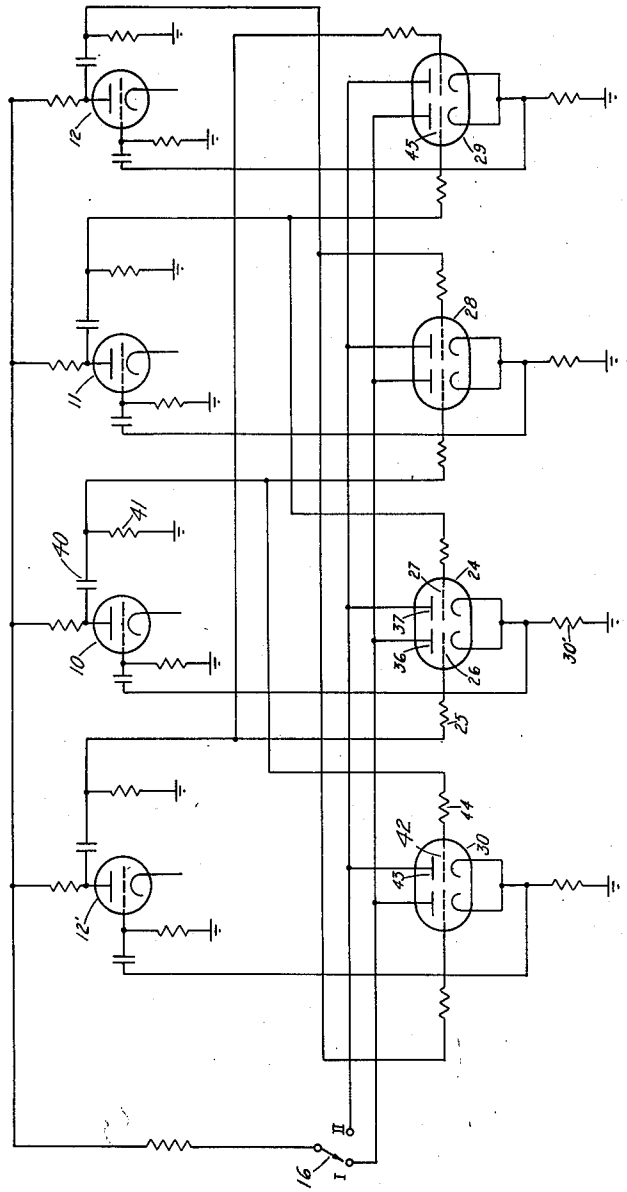


FIGURE 3

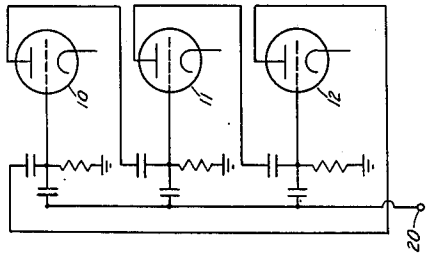


FIGURE 1

THOMAS A. PRUGH
INVENTOR
William D Hall
ATTORNEY

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Filed June 16, 1945 2 Sheets-Sheet 2

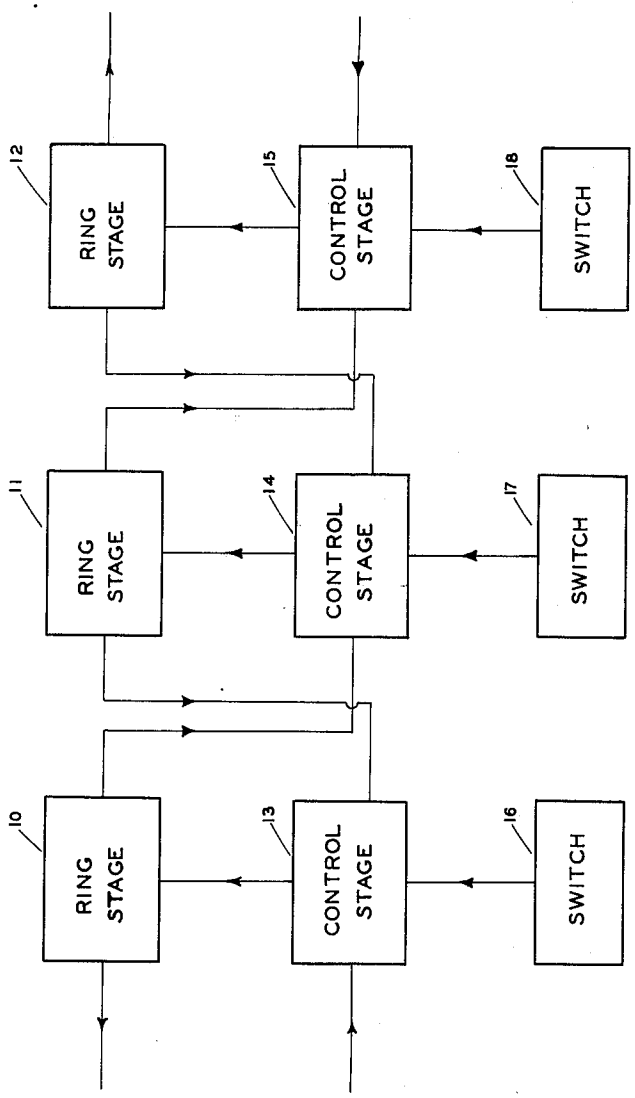


FIGURE 2

THOMAS A. PRUGH
INVENTOR

William D. Hall
ATTORNEY

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UNITED STATES PATENT OFFICE

2,516,146

RING CIRCUIT

Thomas A. Prugh, United States Army,
Arlington County, Va.

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5 Claims. (Cl. 250—27)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

1

The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

This invention is in electrical apparatus and particularly in electronic ring circuits.

The principal object of the invention is to provide means for readily reversing the direction of conduction of an electronic ring circuit.

Another object is to provide novel means for preventing successive conduction of the tubes of a ring circuit.

Other objects will be apparent from a reading of the following specification and claims.

In the drawings:

Figure 1 is a simplified wiring diagram of a portion of a conventional ring circuit such as may be modified in accordance with my invention.

Figure 2 is a block diagram of the principal elements of the invention.

Figure 3 is a schematic diagram of the present invention.

In general, a ring circuit, such as is to be controlled by the present invention, consists of two or more vacuum tube stages interconnected as shown in Figure 1. The circuit is so designed that each stage in turn delivers a positive or negative peaked output to the next. In the present description, the ring circuit will be assumed to be controlled by negative pulses.

Normally, one tube, 10 for example, is conducting, whereas 11 and 12 are cut off. A negative trigger pulse applied to the three tubes simultaneously over line 20 causes tube 10 to cut off, whereupon the positive voltage developed at its plate, applied through a differentiating circuit to the grid of tube 11, produces conduction in the latter tube, this process being continuable as long as triggering pulses are supplied, the next negative pulse, it will be understood, cutting off tube 11 and thereby producing conduction in tube 12.

Referring to Figure 2, the blocks, 10, 11, and 12, represent (just as in Figure 1) three stages of a conventional ring circuit; 13, 14, and 15, electronic means for controlling the conducitivity of the ring stages; and 16, 17, and 18, switching means which determine the mode of action of the control stages, 13, 14, and 15.

To control the order in which the tubes 10, 11, and 12, conduct, a control stage is used with each ring stage. Each control stage, as 13, consists of two cathode follower circuits in the form of a double triode, 24, see Figure 3. The common cathodes of tube 24 are connected to the input of ring tube 10 through a differentiating circuit.

2

The plate of the preceding ring stage, 12', is connected through a differentiating circuit and limiting resistor 25 to the grid, 26, of double triode 24, and grid 27 is similarly connected to the plate of ring stage 11.

Switch 16, controlling the plate bias of tubes 24, 28, 29, and 30, is adapted for connection to one plate of each tube when in one position, and the other plate of each tube when in its second position. Switch 16, in other words, in this figure replaces the several switches 16, 17, and 18 of Figure 2, it being quite permissible to control the switch tubes individually or as a group. The output of tube 24 is taken directly across the cathode resistor, 30'. A positive pulse applied to a grid of the tube will, therefore, provided the corresponding plate is properly biased, cause an increase in current flow through the cathode resistor and a corresponding voltage increase.

When the cathode follower circuit is used to control a ring circuit, tubes 24, 28, 29, and 30 are biased nearly to cut off through their respective cathode resistors. Plate voltages are varied through switch 16 from positive to zero. To cause the ring to conduct in a normal or "forward" direction, one plate of each of the double diodes (as 36 of tube 24) is made positive and the other plate (as 37 in tube 24) is zero.

Assuming a succession of conventional negative triggering pulses to be applied to the circuit of Figure 3, and the ring to be operating, as, for example, tube 10 of the ring circuit begins to cut off, the differentiated positive pulse developed through capacitor 40 and resistor 41 produces conduction in control tube 28 and thus drives the grid of tube 11 more positive than before. The same pulse is, of course, furnished to grid 42 of control tube 30, but there is no change in cathode voltage at this point since plate 43 of control tube 30 is at zero potential, and grid current flow is prevented by the limiting resistor, 44. When the grid of ring tube 11 goes positive, the tube conducts. As it cuts off on the next triggering pulse, it applies a positive pulse to grid 45 of control tube 29, causing tube 12 to conduct.

To reverse the order in which the tubes of the ring circuit begin conducting, switch 16, controlling the cathode followers, is thrown, thus applying positive voltages to those plates of the control tubes which earlier were assumed to be at zero potential and bringing to zero those which were earlier described as positive.

To stop the action of the ring circuit in any one condition, switch 16 is opened, assuring that no

control tube can conduct, and thus no pulse can be transferred from one ring tube to another.

The foregoing description is in specific terms, and many modifications will readily suggest themselves. Obviously, for example, two separate tubes properly connected are the full equivalent of the double tubes indicated. The invention should not, in other words, be considered as limited to the exact apparatus shown and described, but, instead, for the true scope thereof, reference should be had to the appended claims.

I claim:

1. A circuit for controlling a ring circuit of n stages, including n control stages in the nature of double triodes each control stage being so associated with a ring stage that variations in its conductivity produce variations in the conductivity of its ring stage, means for supplying the output of a conducting ring stage to one half of a control stage preceding and to one half of a control stage succeeding the control stage associated with the conducting ring stage thereby to vary the conductivity of a further ring stage.

2. A circuit for controlling a ring circuit including a double triode or the like, means for applying different voltages to the plates of said triode, means for applying the output of said triode to a selected tube of the ring circuit thereby to vary the conductivity of said selected tube, means for associating each of the grids of said triode with a different unselected ring tube whereby conduction of a ring tube may vary the conductivity of said triode.

3. A circuit for controlling a ring circuit including a normally nonconducting double triode or the like having common cathodes, means for applying different voltages to the plates of said triode, means for applying the output of said triode to the grid of a selected tube of the ring circuit thereby to produce conduction in said selected tube, and means for associating each of the grids of said triode with a different unselected ring tube whereby conduction of a ring tube will vary the bias on one grid of said triode.

4. A circuit for controlling a ring circuit including a control stage in the nature of a double triode associated with each ring stage, means for applying different voltages to the two plates of each of the control stages, means for applying simultaneously to the grids of the control stages preceding and succeeding the stage associated with a conducting ring stage a pulse from said last mentioned ring stage to cause conduction in one control stage and thereby conduction in its associated ring stage.

5. A circuit for controlling a ring circuit of n stages, including n control stages in the nature of double triodes having common cathodes and plates which may be individually biased, each control stage being associated with a ring stage for the control thereof, means for supplying the output of a conducting ring stage to one grid each of the control stage preceding and succeeding the control stage associated with the conducting ring stage whereby to produce conduction in a control stage when the plate cooperating with the grid to which the ring output is supplied is biased in one fashion.

THOMAS A. PRUGH.

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